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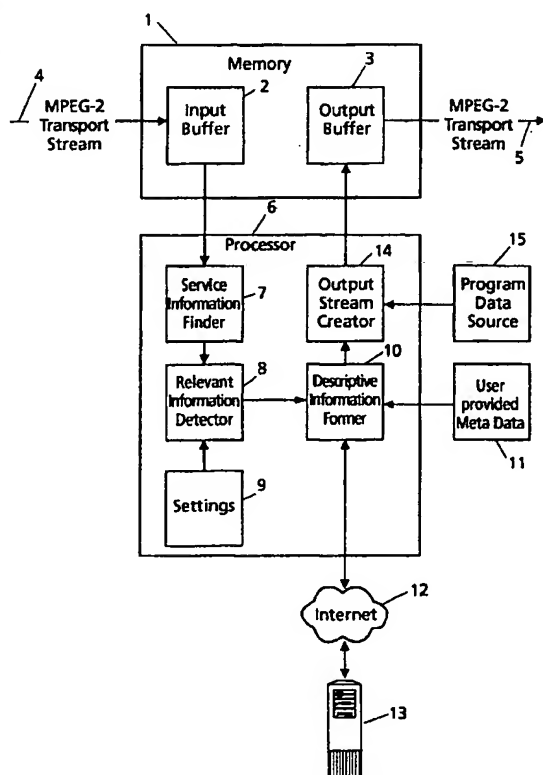
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(75) Inventor/Applicant (for US only): **HEPPER, Dietmar**
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(71) Applicant (for all designated States except US): **THOM-SON LICENSING S.A. [FR/FR]; 46 Quai A. le Gallo, F-92100 Boulogne-Billancourt (FR).**
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(54) Title: **A METHOD AND MICROPROCESSOR SYSTEM FOR FORMING AN OUTPUT DATA STREAM COMPRISING METADATA**



(57) Abstract: A method and an electronic system for forming an output data stream are provided. A corresponding input data stream contains service information that is extracted and transformed into metadata. The service information and the content data comprised in the input data stream are used for generating an output data stream. For example the invention can be used to generate an MPEG-2 output data stream with TV-Anytime / XML metadata based on DVB-SI service information contained in the input data stream.



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A method and microprocessor system for forming an output data stream comprising metadata

The present invention relates to a method and an electronic
5 system for forming an output data stream, in particular for applications to the DVB-SI, TV-Anytime, MPEG-7 and XML standards using the MPEG-2 format as a transport medium.

10 Background

From the prior art a variety of formats for the digital transmission of data is known. The MPEG-2 format is a popular message format for the transmission of digital broad-
15 casting. It has been standardised by the International Standard Organization/International Electrotechnical Commission, Moving Picture Experts Group, ISO/IEC 13818 (MPEG-2). The MPEG-2 standard can be used in conjunction with the DVB-SI standard (Digital Video Broadcasting - Service Information).
20 Some satellite broadcasting systems are currently using MPEG-2 and DVB-SI.

US-A-6 040 850 shows a method for interfacing between a transmitter and a receiver of a digital broadcasting system
25 using a satellite. That method relies on an event information table and a network information table contained in the DVB-SI data to perform a recording, and for inserting a price information descriptor table and a caption information descriptor into the event information table.

30

US-A-6 175 577 shows a transmission system for transmitting a flexible multiplex signal. A plurality of programs is transmitted in the MPEG-2 format. Each program consists of a plurality of elementary streams, which are multiplexed on a

transport stream by a multiplexer. In order to be able to find the different elementary streams, which form a program, several tables are used. The tables can change over time and are updated by information present in the transport stream.

5

Another emerging standard is the "TV-Anytime" standard, which is defined by the TV-Anytime Forum. The TV-Anytime Forum has published metadata specifications that define the attractors and data structures that allow consumers to find, navigate and manage content. The term "metadata" encompasses data that is descriptive about content, such as program title and synopsis.

Such metadata is also referred to as "attractors" because it can attract a consumer to content. Attractors allow consumers to find, navigate and manage content from various sources. In addition to attractors metadata as defined by TV-Anytime also includes information about user preferences and history. User preference information, such as favourite actors or TV-shows, is included within the scope of TV-Anytime metadata to allow software agents to select content on the consumer's behalf.

Invention

25

The metadata representation format is a specification of how TV-Anytime metadata is represented in the extensible mark-up language XML. However the TV-Anytime metadata is not restricted to XML but can also be encoded in a binary format for transmission or storage. Details of the metadata specification are published in the document SP003V10 of 16 February 2001, which is available on the web-site 'www.tv-anytime.org'. So far no transport mechanism is disclosed for the metadata within the scope of the TV-Anytime specification.

The manner in which the metadata is stored, accessed and used on a personal digital recorder (PDR) is not specified.

A problem to be solved by the invention is to provide an improved method and microprocessor system for forming a corresponding output data stream. This problem is solved by applying the respective features of the independent claims. Preferred embodiments of the invention are set forth in the dependent claims.

10

The invention allows converting service information SI, such as DVB-SI, which is contained in an input data stream. The input data stream can be of any kind, such as data streams transmitted via satellite, Internet and/or cable networks in a variety of formats. The service information contained in the input data stream can be converted into a descriptive metadata representation.

In a preferred embodiment of the invention the format of the descriptive representation is the TV-Anytime metadata format that is based on XML. For example, an input data stream of the MPEG-2 format comprising DVB-SI service information data is analysed and the service information data is searched, retrieved and evaluated.

25

The invention allows creating additional descriptive metadata - such as metadata of the TV-Anytime format - in accordance with the target syntax. The metadata conveys the complete service information or a subset of the service information. The subset of the service information can be selected automatically or manually by an operator or agent.

The invention is advantageous in that it allows easing the generation of metadata at e.g. the provider side.

The invention allows to embed the metadata into an output data stream to convey the metadata as a part of the data stream to a user, e.g. via a broadcast channel or the Internet.

5

Alternatively the data stream can also be provided upon a user's specific request for storage and/or rendering on a personal digital recorder (PDR). The metadata received by the user can comprise additional metadata that was not contained in the original DVB-SI data. The additional metadata can be received from a variety of data sources, such as internal or external databases, the Internet or by user input operation.

Advantageously, the invention allows facilitating the creation of descriptive information that is also referred to as metadata, for multimedia content. This minimises the need for user interaction and eases the generation of such metadata at the provider's site at the same time.

20

Based on the extended metadata provided to a user, additional features can be supported on the user's personal digital recorder such as search and navigation features or other useful features relating to the program selection and/or the user interface relying on the metadata.

In principle, the inventive method is suited for forming an output data stream including metadata, the method including the steps of:

- 30 - providing an input data stream comprising service information;
- extracting the service information from the input data stream;
- transforming at least some of the service information into

metadata;

- outputting the output data stream and the metadata.

In principle, the inventive microprocessor system includes
5 microprocessor means adapted for carrying out the steps of
this method.

In principle, the inventive computer program product is
stored on a computer usable medium and includes computer
readable program means for causing an electronic system to
10 perform this method when the program is run on that elec-
tronic system.

Drawings

15

Exemplary embodiments of the invention are described with
reference to the accompanying drawings, which show in:

Fig. 1 flow chart of an embodiment of a method for forming
an output data stream in accordance with the inven-
20 tion;

Fig. 2 block diagram of an embodiment of the electronic sys-
tem in accordance with the invention;

Fig. 3 a table for illustrating the mapping of service data
of the DVB-SI data format to the TV-Anytime / XML
25 data format;

Fig. 4 simplified recorder block diagram.

Exemplary embodiments

30 Fig. 1 shows a flow chart for transforming an input data
stream into an output data stream. For example the input
data stream can have the MPEG-2 data format and comprises
DVB-SI service data, or has the MPEG-4 data format. However
it is to be noted that the invention is not restricted to

these data formats but is applicable broadly to all data formats allowing transporting service information.

In step a) the service information that is embedded in the input data stream is identified and extracted. In step b)
5 the relevant service information is selected. This can be done in accordance with predefined settings, such as a user profile. The settings specify the service information that is considered to be relevant.

In step c) the selective service information is transformed
10 into a metadata format. Again it is to be noted that the invention is not restricted to a specific metadata format. On the contrary, the invention is applicable to any metadata format, such as the TV-Anytime metadata format or other metadata formats used in streaming technologies, such as
15 Real Networks G2 server / real player, Microsoft net show server / player, Apple quick time server / player and IBM video charger / player. The mapping is performed in accordance with a predefined mapping table which assigns specific data format elements of the format in which the service in-
20 formation is received to corresponding elements of the target syntax, such as TV-Anytime / XML. The mapping is explained in greater detail with respect to an instance of a mapping table as depicted in Fig. 3.

In step d) additional descriptive metadata can be added. The
25 additional metadata can be provided by a user or by performing a database query via Internet or an intranet. This step allows adding other relevant data that are considered useful by the service provider and/or the user. Examples for such additional metadata include critics from other users, rating,
30 information on actors and/or on related events.

In step e) additional content data is added to the input data stream. The additional content data can be an additional TV program that is added by the service provider. In this case corresponding additional metadata is also added to

the data stream.

In step f) a data stream is generated with the embedded metadata. In the example considered here the metadata is accommodated by the MPEG-2 transport technology. In most cases
5 it replaces the original DVB-SI service information.

Fig. 2 shows a block diagram of an electronic system. The electronic system includes a memory 1 having an input buffer 2 and an output buffer 3. The input buffer 2 is coupled to a
10 data channel 4, receiving an input data stream such as an input data stream in the MPEG-2 format.

Likewise the output buffer 3 is coupled to a data channel 5 for outputting an output data stream. In the example considered here the output data stream, too, is of the MPEG-2 format.
15 It is also possible to choose a data format for the output data stream that is different to the data format of the input data stream.

The electronic system further includes a processor 6, which has a processor component 7, which is coupled to the input
20 buffer 2. The processor component 7 serves to identify service information in the input data stream.

Processor 6 further includes a processor component 8 for the detection of relevant service information. Processor component 8 is coupled to the processor component 7 and receives
25 service information identified by the processor component 7 at its input. Furthermore, the processor component 8 is coupled to an information source, e.g. a file 9. This file contains the settings specifying which service information is relevant.

30 The output of the processor component 8 is coupled to a processor component 10. Processor component 10 has a further input receiving user-provided metadata 11, and has an interface for coupling it to the Internet 12. This way the processor component 10 can connect for instance to a server or

client computer 13.

For example the processor component 10 can access the computer 13 via the Internet in order to perform a database query of a database stored on the computer 13 in order to
5 retrieve data that relate to the content received by the input data stream over the data channel 4. Based on the relevant service information provided by the processor component 8 and based on the additional data provided by the user and/or data retrieved from the computer 13 the processor component 10 generates the resulting metadata.

Such metadata is output from the processor component 10 to a processor component 14 that integrates the metadata and the original content data for forming an output data stream.

15 It is also possible to filter out certain content and/or to add additional content using a program data source 15. This way it is possible to filter out undesired content, such as undesired television programs, from the input data stream and to add additional content such as an additional TV program provided by the program data source 15. The resulting
20 output data stream is output by processor component 14 and is received by an output buffer 3 from where it is output on data channel 15.

25 It is to be noted that the electronic system of Fig. 2 can be used at any point of the transmission path of the data stream. For example the electronic system can be used by a provider for generating an output data stream that is broadcast to a variety of users, or in response to a specific request received from an individual user. In the latter case
30 the specific user request and/or the user's individual profile determines the settings of file 9.

The electronic system of Fig. 2 can also form part of a user

device such as a personal or network digital recorder (PDR). In this case the metadata is stored locally on the user's behalf. This can be useful for the implementation of search and navigation features on a user device.

5

The output data stream and/or the metadata is stored on a recording medium that is included or inserted in a digital recorder RECD shown in Fig. 4, whereby a universal identifier for referencing the stored data is generated, assigned and/or attached to the stored output data stream and/or to the metadata.

The Content Reference Identifier (CRID) of the TV-Anytime Forum Content Referencing specification can be used by e.g. content providers or service providers, i.e. by sources outside the user's home, for identifying and referencing content provided to a PDR. However, identifying or referencing consumer-created content is not foreseen.

According to the invention, the concept of the CRID is extended and applied to consumer created content by extending the notion of the authority given by TV-Anytime to either a user-specific registered Internet domain name or an ID specific to the PDR, using a manufacturer-specific registered Internet domain name. Thereby content created by the consumer can be identified and referenced by the consumer - as well as by other people or organisations. The extensions generated or desired by a user can be input by a user interface UI. From the data received from interface UI extension data, e.g. CRID extension data, are generated in an extension generator EXTG.

As an alternative, the electronic system of Fig. 2 and the digital recorder of Fig. 4 can form a single device. In such case, the user-provided metadata 11 can be provided by user interface UI, too.

According to the TV-Anytime Forum Content Referencing specification, the CRID syntax is defined as follows:

CRID://<authority>/<data> ,

wherein <authority> is composed as <DNS name><name extension> of a registered Internet domain name <DNS name> and an
5 optional <name extension> starting with a ";" character, and wherein <data> is a free-format string that has a meaning for the <authority> .

According to the invention, the concept of the CRID is extended, i.e. the identifier is amended by allocating to the
10 user a <DNS name>, for instance a registered Internet domain name if the user has one, e.g. 'www.firstname.lastname.de'. This way a piece of content created e.g. by a consumer through a camcorder recording could be referenced, for example by 'CRID://www.an.other.de/hawaii2002-oahu'.
15

Instead of providing an extension by the user, the user's recorder device - e.g. a PDR - can basically automatically provide an extension, wherein <DNS name> is the registered
20 Internet domain name of the device manufacturer, followed by a device-specific string - for instance a serial number - as the <name extension>, e.g. 'www.thomson-multimedia.com;thpdr-xyz2002-abc123'. The piece of content created could be referenced correspondingly by 'CRID://www.thomson-multimedia.
25 com;thpdr-xyz2002-abc123/hawaii2002-oahu'.

As an alternative, the above extended CRID identifiers can have the TV-Anytime or an XML type mark-up language target syntax format instead.
30 The capability of resolving the CRID into a TV-Anytime compliant locator can be provided.

Further it is to be noted that the output data stream provided by the processor component 14 to the output buffer 3

can be sent on request. For example, the electronic system of Fig. 2 can be implemented on an Internet server computer. When a user connects to the server computer he or she can request a particular TV program for streaming. The corresponding output data stream can already be present in the output buffer 3 such that the streaming operation to the end-user can start immediately.

As an alternative to embedding the metadata and the content data into the same output data stream it is also possible to provide the content and the metadata separately. For example the content can be provided by means of the MPEG-2 transport technology, such as via satellite, whereas the metadata is provided to the end-user device through an Internet connection.

Fig. 3 shows an example of the mapping of DVB-SI service data to metadata of the TV-Anytime /XML data format. Each data item of the DVB-SI service information given in this example is translated into corresponding information in the TV-Anytime / XML format.

Claims

1. Method for forming an output data stream (4) including metadata, the method including the steps of:
 - 5 - providing (a) an input data stream comprising service information, e.g. an input data stream having MPEG-2 or MPEG-4 format, the service information having e.g. DVB-SI format;
 - extracting (b) the service information from the input
10 data stream;
 - transforming (c) at least some of the service information into metadata, the metadata having e.g. an extensible mark-up language target syntax format, for example a TV-Anytime and/or an XML type format;
 - 15 - outputting (5) the output data stream and the metadata.
2. Method according to claim 1, the step of extracting the service information being performed in accordance with user-defined settings.
20
3. Method according to claim 1 or 2, further including adding (d) user and/or Internet (12) provided data to the metadata.
- 25 4. Method according to one of claims 1 to 3, further including filtering (14) of the content data comprised in the input data stream in order to filter out undesired content.
- 30 5. Method according to one of claims 1 to 4, further comprising adding (e) additional content data for the generation of the output data stream.
6. Computer program product stored on a computer usable me-

dium, including computer readable program means for causing an electronic system to perform a method according to one of the preceding claims 1 to 5 when the program is run on that electronic system.

5

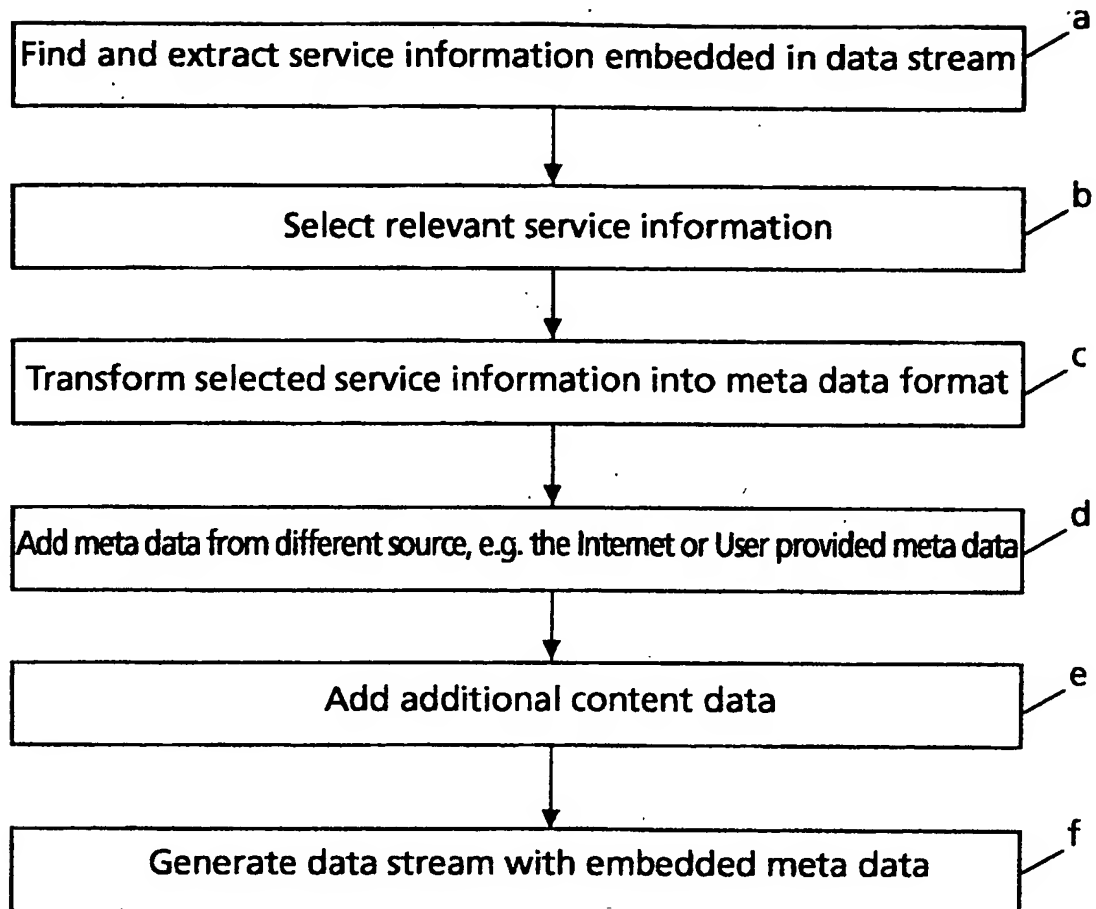
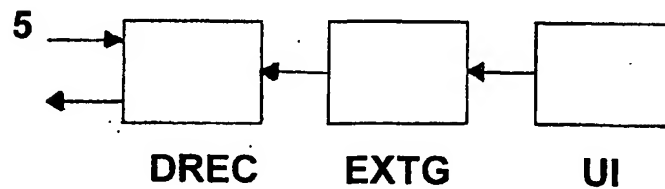
7. Microprocessor system including microprocessor means adapted for carrying out the steps of one of the claims 1 to 5.

- 10 8. Method according to one of claims 1 to 5, wherein said output data stream (5) and/or said metadata is stored on a recording medium using a digital recorder (RECD, EXTG, UI), e.g. a Personal Digital Recorder.

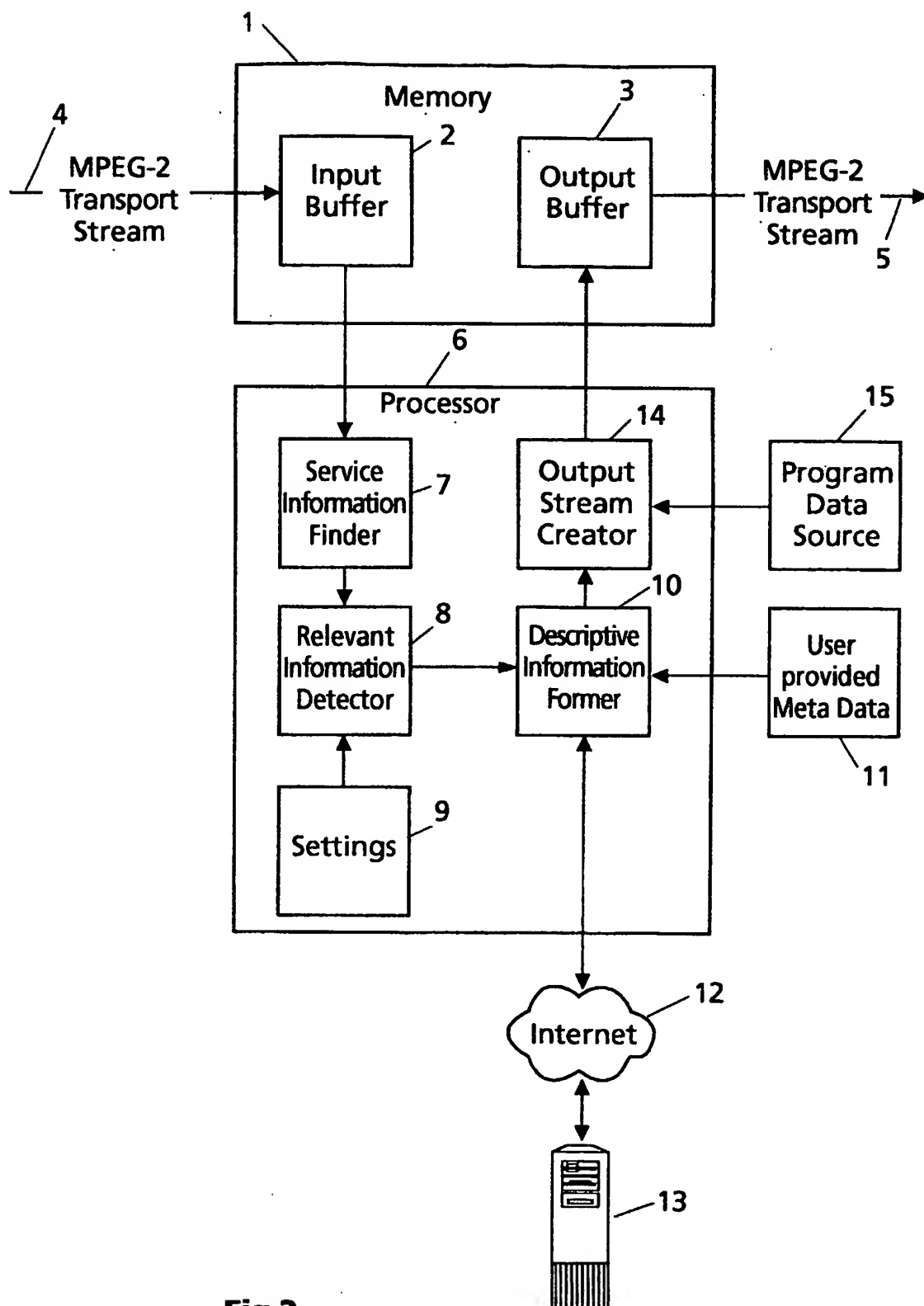
- 15 9. Method according to claim 8, whereby a universal identifier for referencing the stored data is generated and assigned or attached to said stored output data stream and/or to said metadata.

- 20 10. Method according to claim 9, wherein said identifier is an extended CRID or TV-Anytime or XML format identifier that is extended by user-related data, e.g. the user's name or additionally by a user's reference, or is extended by recorder device-related data, e.g. the registered Internet domain name of the recorder device manufacturer followed by a recorder device-specific string, e.g. its serial number, or additionally by a running
25 reference.

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**Fig.1****FIG.4**

2/3

**Fig.2**

3/3

DVB-SI data found in the DVB/MPEG-2 Transport Stream	Descriptive information related to TV-Anytime/XML
	<ProgramInformation>
	<BasicContentDescription>
Event_name_char's="Gandhi" in Short_event_descriptor in EIT	<Title>Gandhi</Title>
Text_char's="The story of ..." in Short_event_descriptor in EIT	<Synopsis>The story of ...</Synopsis>
Content_nibble_level_1="0x1" and Content_nibble_level_2="0x0" for "movie/drama (general)" in Content_descriptor in EIT	<Genre type="main">Drama</Genre>
Stream_content="0x03" and Component_type="0x12" for "DVB subtitles ... for ... 16:9 ..." in EIT	<Subtitled>true</Subtitled>
	<ParentalRating>
Country_code="0100 0111 0100 0010 0101 0010" for "GBR" in Parental_rating_descriptor in EIT	<Country>GBR</Country>
Rating="0x0B" for "11" in Parental_rating_descriptor in EIT and minimum age=rating+3	<MinimumAge>14</MinimumAge>
	</ParentalRating>
	<AVAttributes>
Smoothing_buffer_leak_rate="25" for 5.0 Mbit/s in Short_smoothing_buffer_descriptor in EIT Schedule Table	<BitRate average="5000000"/>
	</AVAttributes>
	</BasicContentDescription>
	<AudioAttributes>
Stream_content="0x02" and Component_type="0x03" for "audio, stereo (2 channel)" in EIT	<NumOfChannels>2</NumOfChannels>
	</AudioAttributes>
	<VideoAttributes>
Stream_content="0x01" and Component_type="0x03" for "video, 16:9 aspect ratio without pan vectors" in EIT	<AspectRatio>16:9</AspectRatio>
	</VideoAttributes>
	</ProgramInformation>
	<EventInformation>
Content_nibble_level_1="0xB" and Content_nibble_level_2="0x3" for "live broadcast" in Content_descriptor in EIT	<Live>true</Live>
	</EventInformation>

Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 02/02240

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04N7/24 H04N5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04N G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	paragraph '0003! - paragraph '0006! paragraph '0018! - paragraph '0033!	2-10
P, X	EP 1 100 268 A (SHARP KK) 16 May 2001 (2001-05-16)	1-4, 6, 7
A	paragraph '0052!	5
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P, A	paragraph '0001! - paragraph '0015! paragraph '0051! - paragraph '0066!	3-10
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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O document referring to an oral disclosure, use, exhibition or other means

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X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

6 May 2002

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14/05/2002

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European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Marie-Julie, J-M

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 02/02240

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 02/02240

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